

SNS COLLEGE OF NURSING
SNS Kalvi Nagar, Coimbatore - 35
Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF NURSING

COURSE NAME : BIOCHEMISTRY

TOPIC : CARBOHYDRATES – CLASSIFICATION AND FUNCTIONS

FACULTY NAME: MITHRA V

INTRODUCTION

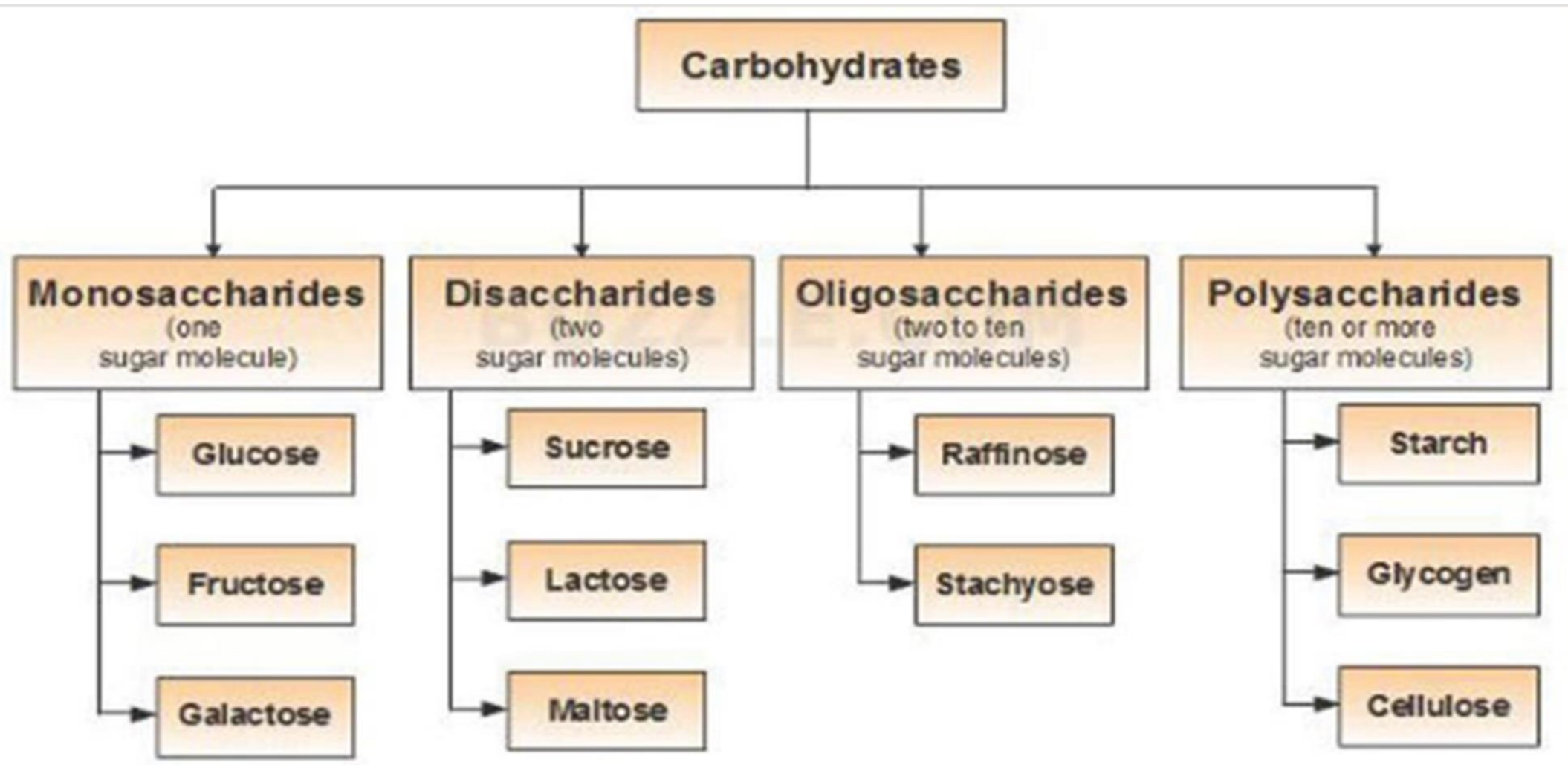
- Carbohydrates, or carbs, are sugar molecules.
- Along with proteins and fats, carbohydrates are one of three main nutrients found in foods and drinks.
- Our body breaks down carbohydrates into glucose.
- Glucose, or blood sugar, is the main source of energy for your body's cells, tissues, and organs.
- Glucose can be used immediately or stored in the liver and muscles for later use.

- Common foods with carbohydrates include:
- Grains, such as bread, noodles, pasta, crackers, cereals, and rice
- Fruits, such as apples, bananas, berries, mangoes, melons, and oranges
- Dairy products, such as milk and yogurt
- Legumes, including dried beans, lentils, and peas
- Snack foods and sweets, such as cakes, cookies, candy, and other desserts
- Juices, regular sodas, fruit drinks, sports drinks, and energy drinks that contain sugar
- Starchy vegetables, such as potatoes, corn, and peas

STRUCTURE OF CARBOHYDRATES

- Carbohydrates consist of carbon, hydrogen, and oxygen.
- The general empirical structure for carbohydrates is $(CH_2O)_n$.
- They are organic compounds organized in the form of aldehydes or ketones with multiple hydroxyl groups coming off the carbon chain.
- The carbohydrates can be structurally represented in any of the three forms:
 - Open chain structure
 - Hemi-acetal structure
 - Haworth structure
- **Open chain structure** - It is the long straight-chain form of carbohydrates.
- **Hemi-acetal structure** - Here the 1st carbon of the glucose condenses with the -OH group of the 5th carbon to form a ring structure.
- **Haworth structure** - It is the presence of the pyranose ring structure.

CLASSIFICATION OF CARBOHYDRATES



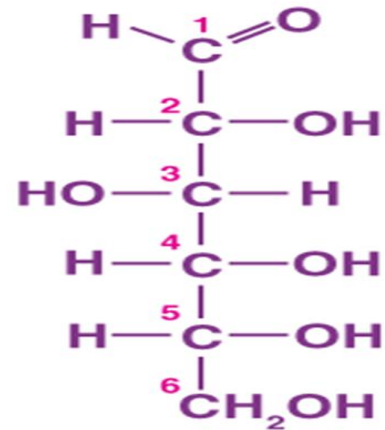
MONOSACCHARIDES

- The building blocks of all carbohydrates are simple sugars called monosaccharides.
- A monosaccharide can be a polyhydroxy aldehyde (aldose) or a polyhydroxy ketone (ketose).
- If a monosaccharide contains an aldehyde group then it is called aldose and on the other hand, if it contains a keto group then it is called a ketose.
- One of the most important monosaccharides is glucose.

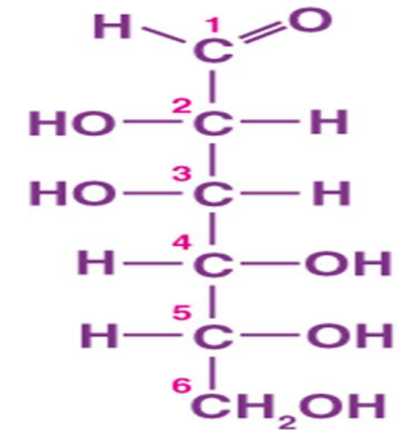
GLUCOSE

- Glucose is also called aldohexose and dextrose and is abundant on earth.
- Glucose is named as D (+)-glucose, D represents the configuration whereas (+) represents the dextrorotatory nature of the molecule.
- The ring structure of glucose can explain many properties of glucose which cannot be figured by open- chain structure.
- The cyclic structure is also called pyranose structure due to its analogy with pyran.

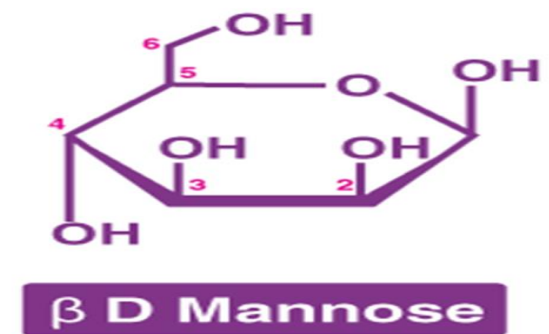
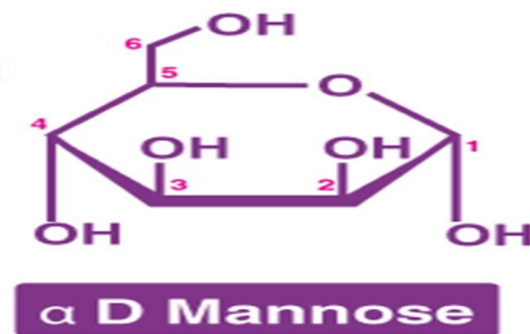
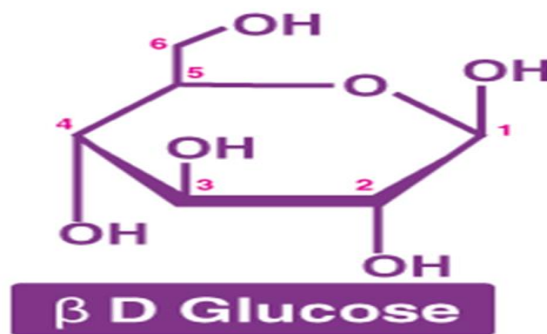
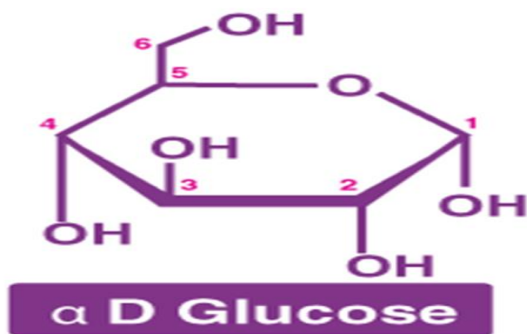
The cyclic structure of glucose is given below:



D Glucose



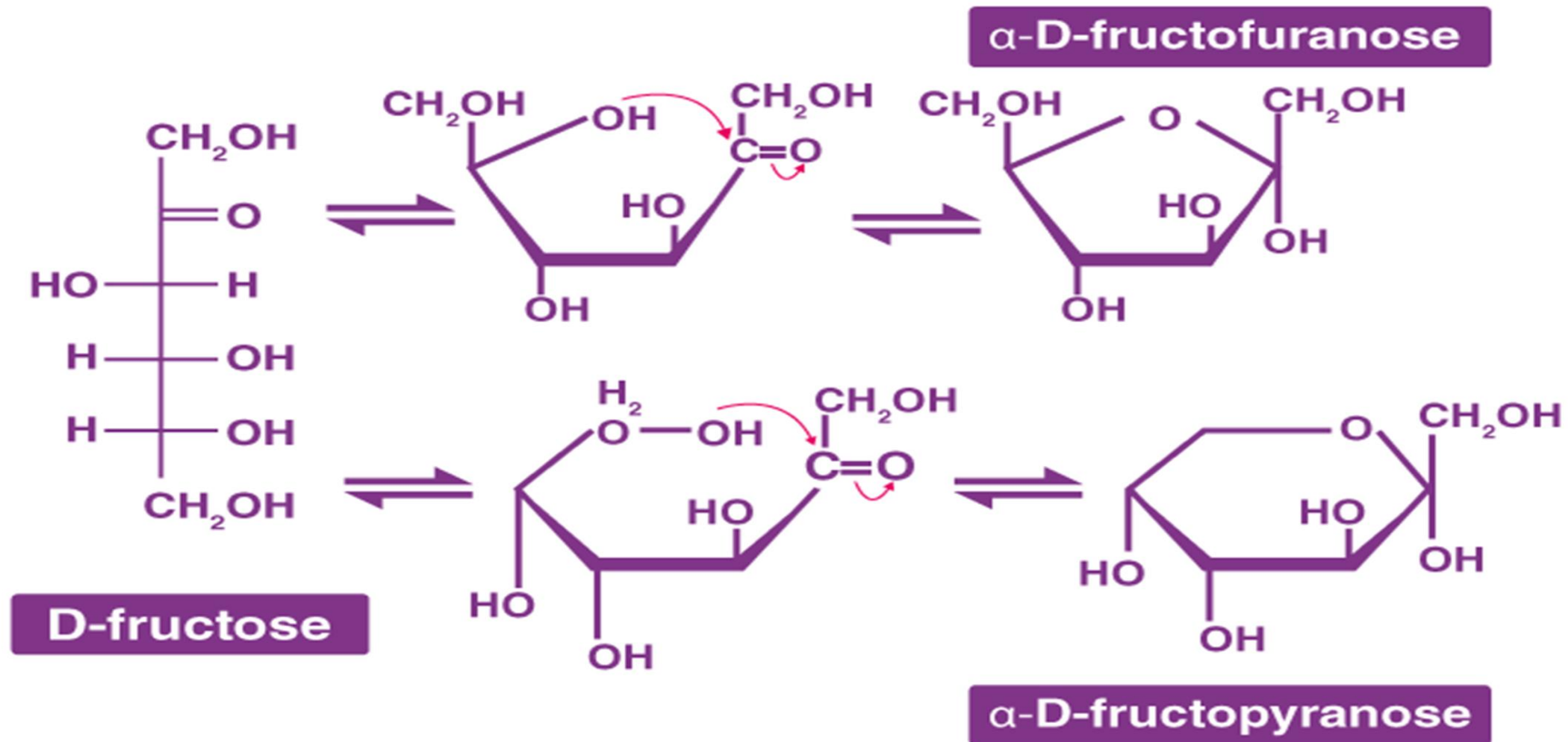
D Mannose



FRUCTOSE

- It is an important ketohexose.
- The molecular formula of fructose is $C_6H_{12}O_6$ and contains a ketonic functional group at carbon number 2 and has six carbon atoms in a straight chain.
- The ring member of fructose is in analogy to the compound Furan and is named furanose.

The cyclic structure of fructose is shown below:



DISACCHARIDES

- On hydrolysis, disaccharides yield two molecules of either the same or different monosaccharides.
- The two monosaccharide units are joined by oxide linkage which is formed by the loss of water molecule and this linkage is called glycosidic linkage.
- Sucrose is one of the most common disaccharides which on hydrolysis gives glucose and fructose.
- Maltose and Lactose (also known as milk sugar) are the other two important disaccharides.

POLYSACCHARIDES

- Polysaccharides contain long monosaccharide units joined together by glycosidic linkage.
- Most of them act as food storage for e.g. Starch - main storage polysaccharide for plants.
- It is a polymer of a glucose and consists of two components-Amylose and Amylopectin.
- Cellulose is also one of the polysaccharides that are mostly found in plants.
- Polysaccharides are also called "glycans".
- Polysaccharides contain more than 10 monosaccharide units and can be hundreds of sugar units in length.
- They yield more than 10 molecules of monosaccharides on hydrolysis.

- They may be homopolysaccharides/ Homoglycans, containing monosaccharides of the same type (Contains more than 10 same repeating units.)
- Examples are starch, glycogen, cellulose, pectin.
- Heteropolysaccharides/ Heteroglycans i.e., monosaccharides of different types (Contains more than 10 different repeating units.)
- Examples are Hyaluronic acid, Chondroitin.

HOMOPOLYSACCHARIDES

- Homopolysaccharides are chemical compounds that are composed of a single type of monomer
- Composed of the same repeating unit
- Single type of monosaccharide is involved in the formation
- Have simple structures when compared to heteropolysaccharides

HETEROPOLYSACCHARIDES

- Heteropolysaccharides are polysaccharides made out of two or more different monosaccharides
- Composed Of different repeating units
- Different types of monosaccharides are involved in the formation
- Have complex structures

OLIGOSACCHARIDES

- Oligosaccharides are compound sugars that yield 2 to 10 molecules of the same or different monosaccharides on hydrolysis.
- Based on the number of monosaccharide units, it is further classified as a disaccharide, trisaccharide, tetrasaccharide, etc.
- Oligosaccharides yielding 2 molecules of monosaccharides on hydrolysis is known as a disaccharide, and the ones yielding 3 or 4 monosaccharides are known as trisaccharides and tetrasaccharides respectively, and so on.

Examples: Disaccharides include sucrose, lactose, maltose, etc.

Trisaccharides are Raffinose, Rabinose.

Functions of Carbohydrates

- Carbohydrates are widely distributed molecules in plant and animal tissues.
- They are important energy sources required for various metabolic activities, the energy is derived by oxidation.
- Living organisms use carbohydrates as accessible energy to fuel cellular reactions.
- They are the most abundant dietary source of energy (4kcal/gram) for all living beings.
- Glucose is broken down by glycolysis/ Krebs's cycle to yield ATP, it serve as energy stores, fuels, and metabolic intermediates.
- It is stored as glycogen in animals and starch in plants.
- Stored carbohydrates act as an energy source instead of proteins.

THANK YOU